

# A climate protection strategy for the city of Bad Hersfeld

Oliver Wagner  
Wuppertal Institute for Climate, Energy, Environment  
Germany  
oliver.wagner@wupperinst.org

Kurt Berlo  
Wuppertal Institute for Climate, Energy, Environment  
Germany  
kurt.berlo@wupperinst.org

Anja Bierwirth  
Wuppertal Institute for Climate, Energy, Environment  
Germany  
anja.bierwirth@wupperinst.org

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## Abstract

Bad Hersfeld is a small city with about 30.000 inhabitants situated in the middle of Germany. Climate Protection has been on the political agenda in Bad Hersfeld since quite a while. In 1997 the Wuppertal Institute elaborated a first energy and CO<sub>2</sub> balance for the city, which was updated in 2007. With the compilation of the CO<sub>2</sub> balance it was shown that the emissions in Bad Hersfeld almost stayed at a constant level between 1997 and 2006.

The result was sobering for the local authority. Although some single measures had been implemented, there was no improvement of the CO<sub>2</sub>-balance (see figure 1).

It was concluded that a successful climate protection strategy needs a comprehensive concept comprising all sectors and a periodic monitoring. Bad Hersfeld commissioned the Wuppertal Institute to develop feasible measures to reduce the CO<sub>2</sub> emissions drastically and instruments to overcome existing barriers. In a close cooperation with the City Council and the local municipal utility a climate protection concept was compiled that is rather ambitious for a city of this size.

In consideration of the regional peculiarities<sup>12</sup> concrete measures and 7 accompanying measures build the core of the concept with a main focus on energy efficiency (final energy), combined heat and power (CHP) and renewable energies. Another important part of the concept is a municipal support pro-

gramme to develop the endogenous efficiency potentials and renewable energies in the region. Further to these planning instruments, information and networking activities are compiled as well as a variety of suggestions for a climate protection marketing (Wagner 2008).

Some of these measures that were developed in an iterative and cooperative process between the responsible actors in Bad Hersfeld and the Wuppertal Institute are transferable to other cities and towns. The impeding factors in Bad Hersfeld like the user-investor dilemma, the low capital of small housing associations or the large stock of listed historical buildings, are typical for cities of this size.

## Introduction

In the Agenda 21, that was adopted in 1992 on the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, cities and local authorities were mentioned as important actors in implementing climate protection measures (United Nations Division for Sustainable Development, 1992). It is almost contradicted that many global environmental problems have their source in local activities. Accordingly it makes sense to look for solutions at this level. "Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and subnational environmental policies. As the level of governance closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development." (Agenda 21, Chap. 28.1)

Furthermore, a need for action is given for the local authorities by changing framework requirements. With the implemen-

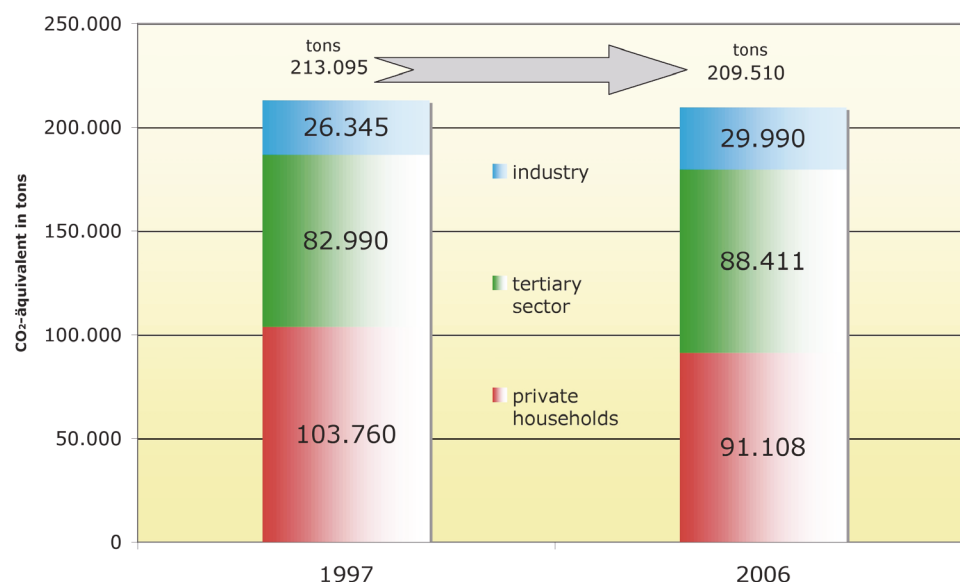


Figure 1. Development of CO<sub>2</sub> emissions in the City of Bad Hersfeld

tation of the Integrated Energy and Climate Programme (IEKP) of the German Government, the climate protection package “20 20 20 by 2020” from March 2007 and January 23<sup>rd</sup> 2008, the Energy End-use Efficiency and Energy Services Directive that entered into force in May 2006 and, based on this, the German National Energy Efficiency Action Plan, the guidelines are strengthened and the market of climate protection activities is stimulated (BMU 2007; Commission of the European Communities, 2008).

For this challenge, Germany gives support to its municipalities by funding the compilation of a CO<sub>2</sub> balance and, based on this, a climate protection concept. Many municipalities already have taken advantage of this opportunity.

#### THE MAIN SECTORS

In Bad Hersfeld as well as all over Germany, private households and especially space heating contribute a large share to final energy consumption. In 2006, the residential heating and appliance use had a share of 45% of the overall energy end-use and 43.5% of all greenhouse gas emissions in Bad Hersfeld, excluding transport and non energy emissions.

A high reduction potential exists especially within the group of existing buildings where energy consumption can be considerably lowered by energetic refurbishment, partly up to 80%. In Bad Hersfeld different factors come together: first, there is a high number of one- and two-family houses which have a higher energy demand per square metre than comparable multi-family houses. Second, the stock of old buildings is relative high. About three-fourths of the dwellings were built before the first Heat Insulation Ordinance (Wärmeschutzverordnung – WschVO) in Germany came into force with minimum standard requirements for the heat transmission of the structural elements of buildings in 1977. There are buildings of the post-World War II period, when many housings were needed, built with a high energy demand as a result of shortage of money, material and missing building regulations as well as old buildings which require special treatment because of being listed and/or half-timbered construction (see figure 2). Hence 77%

of the existing buildings consume 95% of the energy that is committed in this sector.

The reduction potential in the private household sector is far from being tapped. One of the reasons is the increase of living space per person which is contradictory to energy savings by efficiency technologies and energetic refurbishment (UBA 2006). Since the last CO<sub>2</sub> balance from 1997, the average living space per person in Bad Hersfeld rose from 36.7 m<sup>2</sup> to 41.8 m<sup>2</sup> (+14%). Other reasons are obstacles and inhibiting factors of energetic refurbishment like the investor-user dilemma, the lack of information, and missing capital for the owners to implement cost-effective retrofitting measures.

Among the main emittants in Bad Hersfeld the energy consumers in the tertiary sector rank second with 40.8% of the energy use and 42.2% of the greenhouse gas emissions. The industry sector only contributes 14.8% to the CO<sub>2</sub> emissions in Bad Hersfeld (see figures 1 and 3).

#### RESPONSIBILITIES

In order to reach the national climate protection targets, municipalities have to contribute considerably. In many aspects they can be model and header for the citizens. The local authority of Bad Hersfeld is aware of this responsibility and intends to offer incentives by own measures in addition to the support programmes of the federal government and the state of Hessen.

Considering the latest development of the energy market, a significant decline in sales can be expected for energy provision and delivery from fossil fuels in the future<sup>1</sup>. This will effect the future development of the “Stadtwerke Bad Hersfeld GmbH” (Bad Hersfeld Municipal Utility), too. To succeed in this competition and to generate additional sales, the Wuppertal Institute suggested the municipal utility to develop as an appropriate measure different energy efficiency services. With

1. This is a result of the research partnership INFRAFUTUR between 13 municipal companies of the supply, sewage, and waste sectors with the Wuppertal Institute, the association of municipal companies (VKU) and the VKU's working group for rational use of energy and water (ASEW).



Figure 2. Half-timbered house and old town hall in Bad Hersfeld

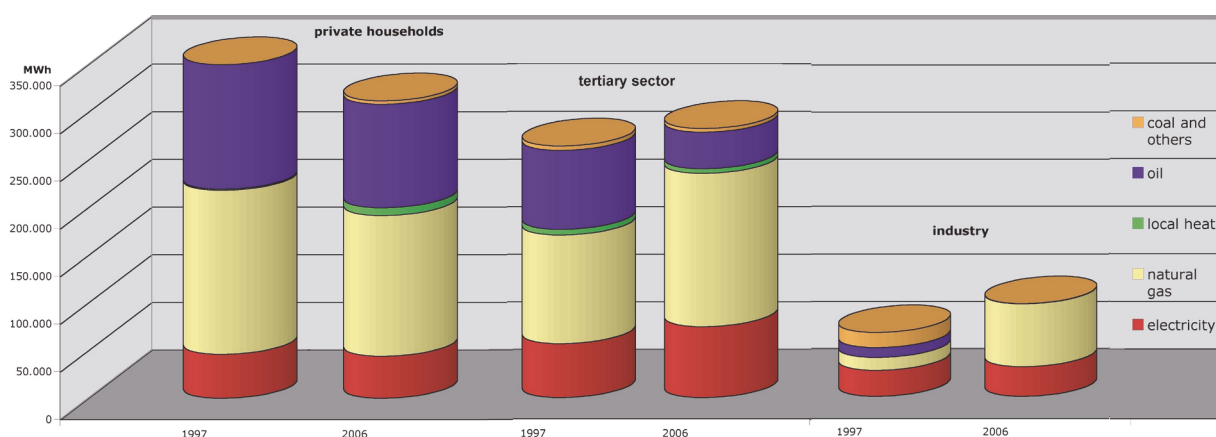


Figure 3. Energy consumption of private households, small- and medium-sized-businesses and industry

the extension of new business fields in the markets of energy efficiency services, combined heat (cold) and power, and renewable energies the Stadtwerke Bad Hersfeld can use their advantages like the vicinity of customers, public confidence and local knowledge against competing companies. At the same time, they can help to overcome existing barriers against the realisation of economic energy reduction potentials. In this way, they can develop climate protection as a business area.

### Proposed measures for Bad Hersfeld

After evaluating the CO<sub>2</sub>-Balance and identifying the sectors with the highest emissions, after finding out about the local peculiarities and after numerous on-site meetings with different groups (for example the local housing association), 12 climate protection measures and 7 accompanying measures were concluded for Bad Hersfeld. The accompanying measures should reach a broad public and strengthen the main measures.

#### THE MAIN MEASURES IN DETAIL

Because of the reasons mentioned above, the main part of the measures is targeting reductions in the sector of buildings, especially space heating. But it is not only about putting in new efficient technologies, but primarily about the energetic refurbishment of existing buildings, taking advantage of legal

obligations like the energy performance certificate for buildings and including soft measures to influence the behaviour of consumers. For this last issue measures were developed to reach a broad public on the one hand and a direct approach to specific target groups to reach owners as well as tenants and users on the other hand.

#### Measure 1: Refurbishment fund for existing buildings

The federal government and state support programmes cannot overcome all obstacles for energetic refurbishment. Here a municipal support programme can close the gaps in energy efficiency investment left by the local particularities. The challenge of the refurbishment fund for existing buildings is to fund energy-efficient refurbishment and to be an organisational and financial platform for the implementation of different measures. The financing can be provided by a fund that is supplied by different sources like the communal budget, restricted allocation and subsidies by the federal government or the federal state, capital from public enterprises and the local credit services sector and by donations. The money should be spent according to standard criteria.

**Measure 2: Refurbishment adviser for housing estates**

Housing estates with a high number of rented flats and estates of the post-war years with a diversified and disproportionate number of old owners can show refurbishment backlogs, if the buildings were modernised insufficiently. The refurbishment adviser shall help to overcome existing obstacles and convince the owners of buildings in need of rehabilitation of an energetic retrofitting. In the future, several measures of organisation, cost-effectiveness, help and relief during the construction shall be offered to the owners.

**Measure 3: Low energy standard in existing buildings**

With the selection of single modernisation measures, a big part of the reduction potentials in existing buildings remains unused. Considering the background of the amendment to the Energy Saving Regulation, this measure shall stimulate tapping the full potential with a comprehensive and anticipatory refurbishment concept.

An approach to develop a municipal support programme can be the pilot project “Efficient Homes” that was started in 2003 by the German Energy Agency (dena). With more than 140 reconstruction projects, it could be shown that existing buildings can reach an energy consumption level 50% lower than that required for new buildings (dena 2004). In the course of the programme additional funding and a platform for knowledge exchange was provided.

**Measure 4: Substituting heating systems and optimizing the of space heating systems in existing buildings**

The next proposed measure is a support programme for the substitution of heating systems, the replacement of electric night storage heaters, firing equipment for solids and old heating systems in need of modernisation. It should be considered that in Germany the exchange of night storage heaters becomes obligatory from January 1<sup>st</sup> 2009, step by step with the amendment to the Energy Saving Regulation (BMU 2007, IZES 2007). The support programme is to accelerate the conversion to modern and efficient heating systems. Further, a concept for a heating contracting service was elaborated for the municipal utility. The contracting shall help to overcome investment obstacles and to develop a sustainable business segment for the utility. Further parts of the support programme focus on optimizing existing heating systems: Hydraulic adjustment, replacement of old circulation pumps by new high-efficiency pumps, the installation of intelligent thermostatic valves and a controlled comfort ventilation, which can altogether lead to high energy reductions.

**Measure 5: Distributed CHP systems**

The analysis of a possible supply of district heat from a gas-steam power plant which is planned about 8km from Bad Hersfeld showed that the demand is too small to be cost-effective. A decentralised structure of several smaller block heat and power plants will be more suitable for Bad Hersfeld. For their promotion, a support programme was suggested subject to the engine power. In the beginning, the local utility company was sceptical. But soon the decentralised CHP scheme was convincing because it can reduce the dependency on the supply of power by third parties and the peak load. Finally, the local utility company can offer new services on the technological sector.

**Measure 6: Refurbishment measures for special target groups**

The existing support programmes for the refurbishment of existing buildings cannot reach some of the owners and overcome specific obstacles. Therefore in Bad Hersfeld the target groups

- owners of listed buildings
- owners of terraced houses who are planning a collective insulation
- owners in a residential area who are planning a collective heat supply

were identified and special supporting measures were developed.

**Measure 7: Qualified and demand-based Energy Performance Certificate and consultation**

Since January 1<sup>st</sup> 2009 in Germany an Energy Performance Certificate has to be provided for buildings that shall be rented, sold or leased. New buildings usually get a requirement based certificate for which the required energy is calculated by the energetic condition and the technical equipment of the building. Some existing buildings can chose a consumption based certificate, depending on the year of construction. The basis for this certificate is the energy consumption of the last three years. But of course the energy consumption depends on the behaviour of the inhabitants and therefore it is not very informative. That is why in Bad Hersfeld a support programme should be launched for a qualified, demand-based Energy Performance Certificate including expert advice. The financial support is subject to the realised reconstruction measures, which shall provide momentum for energetic refurbishment.

**Measure 8: Re-insulation**

A special group are buildings that were insulated in the 1970s or early 1980s. The former standards for the insulation thickness only was between 2 and 6 cm, and seen from today's perspective the material was suboptimal and the construction work of minor quality (especially in regards to thermal bridges). These buildings have a significant energy reduction potential, too, but generally it is necessary to remove and dispose of the existing insulation which means extra effort and costs and as a result additional barriers. The idea that was developed for Bad Hersfeld is that in these cases the local waste company offers the free disposal of the material and the municipality bears the costs.

**Measure 9: Municipal utilities' energy services campaign**

In the future, it will be important for local utility companies to develop new business sectors. The “business behind the meter” will play an important role. With various services (like the ones mentioned above and others) the companies cannot only use the ecological and economic advantages, but, additionally increase the customer's satisfaction and tighten the relationship (Wuppertal Institute 2008a, 2008b). The developed marketable products and services in the sector of energy efficiency are generally differentiated by electricity efficiency services, gas and heating/cooling services including systemic services and analysis, surveys and consultations. For the different customer groups (local key accounts and industry clients, small and medium sized businesses and customer pooling, public real estates and private households) adequate offers were developed.

**Measure 10: Wood energy campaign**

A first rough estimation shows a rather high potential for increasing the use of wood energy in Bad Hersfeld. Bad Hersfeld and its surroundings have a high forest stand with consequently a lot of waste and dead wood. Furthermore, there are several local saw mills whose waste wood can be used.

The idea of the concept is to use these potentials in a cooperation with a special interest group for social matters, the local job centre<sup>2</sup>, the Stadtwerke Bad Hersfeld and the local forest enterprise. An eco-social qualification project will be founded where unemployed persons are engaged to collect, sort out and continue processing the waste and dead wood, that is not used commercially today. The advantage for the unemployed persons is a training and qualification by an ecological work. In a second step, the local authority should choose one or two objects in which a wood fired heating can be installed to use the manufactured wooden fuel.

**Measure 11: Citizen investment in energy efficiency and solar energy in schools**

The Wuppertal Institute developed a "Solar&Save" concept for realizing the saving potentials in school buildings. The idea is to prove that the combination of solar energy with energy and water savings can be economically profitable. Schools in Bad Hersfeld can be retrofitted with energy saving measures and equipped with solar PV energy. Besides retrofitting the lighting system by highly efficient luminaries and control systems, efficiency improvements can be implemented for the ventilation, pumps and the heating system. A combined heat and power plant (for example, 50 kWh electric power) can be installed. To draw out this proposal and to make concrete suggestions, detailed investigations of local schools are required. The project can mostly be financed by citizens of Bad Hersfeld and other private investors; the financial gap can be covered with a loan from the bank. Experiences from other "Solar&Save-Projects" attest, that the return of investment can be between 5 and 10% per year, and a CO<sub>2</sub>-reduction of more than 80% can be achieved (Berlo / Seifried 2007).

**Measure 12: The municipality as a leader**

As already mentioned, the decisions and activities of the municipality always transfer a model and leadership to the citizens thus encouraging imitation. So Bad Hersfeld should be exemplary in some sectors. Therefore, the concept suggests a model refurbishment of a central firestation, an internal training for the staff in public buildings to learn energy-conscious behaviour and the implementation of a directive for energy-efficient procurement (Ökopol 2003).

**THE ACCOMPANYING MEASURES IN DETAIL****Measure 1: Carbon neutral Festival Bad Hersfeld**

Bad Hersfeld holds a widely known theatre festival for more than 50 years now. Considering the background of the climate protection campaign, the idea came up to organise a carbon-neutral festival in the future. For the city as organiser, there

will be positive effects like a concrete contribution to climate protection, a positive image effect and additional national media presence.

**Measure 2: Information campaign: right heating and ventilation – reducing costs and mildew**

Besides the energetic state of the building, that was considered in many of the previous measures, the tenant behaviour has a significant effect on energy consumption. But the right heating and ventilation is not only a way to save energy costs but to avoid mildew, too, which is important for a good and healthy indoor climate. This problem becomes increasingly important in Bad Hersfeld. Therefore a communication concept shall be developed in which a team of experts visits the tenants of affected flats and informs about causes and consequences of mildew (UBA 2002).

**Measure 3: Energy saving consulting for low-income households**

This measure shall promote the re-employment of people who have drawn a long term unemployment compensation (ALG II) and, at the same time help to reduce energy consumption in low-income households. The unemployed persons will be qualified as an energy saving advisor. Then they will arrange free on-site energy consultations in households with low income. The households (or the city that gives the social aid money for the energy expenses) can reduce their expenses, outstanding payments for energy consumption can be reduced, which has a positive effect for the local utility. The model for this idea is the "Cariteam Energy Saving Service" that was established in Frankfurt am Main. Their experiences show that there are high reduction potentials in low-income households because of low standards in electric equipment and a wide spread lack of knowledge about efficiency potentials.

**Measure 4: Saving energy through efficient lighting, cooling etc.**

This measure aims at the trade and industry sector with information on energy saving potentials in lighting and cooling. Recent market data on energy consumption show that energy efficiency of appliances varies considerably. For example the energy efficiency of refrigerators equipped with glass-doors (climate class 4 according to EN 441 or EN ISO 23953 specification) per hundred litres of net volume varies between 0,4 and 2,6 kWh/24h or by more than a factor 5. As in the following measure, too, the local trade and industry shall be given incentives to stay in Bad Hersfeld. Interesting support programmes shall be pointed out and the competitive situation of the local business shall be improved by helping to reduce their energy consumption.

**Measure 5: Addressing specific sectors**

In Bad Hersfeld as a health resort with an annual festival, the hotel and restaurant sector is an important subsector for the city. Restaurants are very energy intensive. In Bad Hersfeld, hotels and restaurants consumed 37.000 MWh of energy in 2006 which is 13% of all used energy of the tertiary sector. Therefore it is suggested that the city and the local utility organise meetings to which the local retailers and the operators of the hotels and restaurants are invited. These information meetings are held to promote energy reduction in this sector. A cooperation

2. For example, with so called 1-Euro-jobs (a kind of workfare) that are basically considered to be a sort of job of community service that people must do in return for unemployment benefits (plus one Euro per hour).

with the responsible energy agency (Hessische Energieagentur) and the consumer advice centre is recommended.

#### **Measure 6: Regular roundtable on energy issues**

A good way to offer a platform to people interested in general energy issues or special questions is a regular information meeting. For Bad Hersfeld it was proposed to invite experts to defined themes who are able to communicate information and answer questions in an informal atmosphere. The meeting could start with a short lecture and there should be enough time for questions and discussions in the end.

#### **Measure 7: Refurbishment market / Refurbishment trade fair for house owners**

At the suggested refurbishment trade fair, house owners shall have the possibility to get in contact with contractors and services business that are needed for a refurbishment measure. Local business like carpenters, painters, chimney sweepers and heating installers, solar companies, engineering companies, architects, the local utility and the local authority should participate with information stands. In this way, it can be a comprehensive information market for energy-saving technologies and services of local companies.

### **Results and outlook**

In the forthcoming years, the city of Bad Hersfeld wants to implement step by step the measures of the climate protection catalogue that were developed with the Wuppertal Institute. The political decisions for this are already made. For the first three years, the local authority intends to invest 400.000 Euro and the Stadtwerke Bad Hersfeld (the municipal utility) will contribute the same amount of money. As a first step, the position of a climate protection commissioner was established who will be responsible for the implementation and monitoring of the numerous measures. In a next step, the local utility asked the Wuppertal Institute to examine an existing utility-supplied heat network whether an energetic improvement, for example the installation of a small heat and power plant, will be ecologically and economically worthwhile. Furthermore, a roof for a solar plant with a capacity of 2,5 MW<sub>peak</sub> was found and a model of citizen's participation for its realisation is under way. In preparation for further implementation steps, detailed analysis has to be continued, to allow a profound forecast regarding the profitability and the contribution to climate protection of the different measures in their specific configuration.

Most of the measures that were developed for Bad Hersfeld can be translated to other cities and towns and adopted to different regional specifics.

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